

LOWER VISÉAN TRILOBITES FROM FELTRIM, IRELAND

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ABSTRACT. *Archegonus (Weania) feltrimensis* sp. nov. is described from the Lower Viséan of Feltrim, Co. Dublin, Ireland. This species combines characteristics of *A. (Weania)* with those of *A. (Waribole)* and *A. (Angustibole)* and shows that *A. (Weania)* evolved from the *A. (Waribole)* stock and not from *Cyrtosymbole (Pseudowaribole)* as supposed by Osmólska.

HUDSON *et al.* (1966a, b) described an outcrop of richly fossiliferous Lower Viséan pyritic mudstones at Feltrim, Co. Dublin, Ireland, lying above an Upper Tournaisian reef-knoll complex. More than 400 trilobite specimens were collected and most of these were assigned by Hudson *et al.* to *Cyrtosymbole (Waribole)* cf. *colei* (M'Coy 1844). Five specimens were identified as *Brachymetopus* sp.

Comparison of the material from Feltrim with the lectotype of '*P.*' *colei* figured by Osmólska (1970, pl. 1, fig. 13) shows that the Feltrim material is specifically distinct. The Feltrim material may be assigned to *Archegonus (Weania)* Campbell and Engel 1963 though it has some of the features diagnostic of *A. (Waribole)* R. and E. Richter 1926, *A. (Belgibole)* G. Hahn 1963, and *A. (Angustibole)* G. Hahn 1965. '*P.*' *colei* shows a combination of features which makes it distinct from *A. (Weania)* and other described subgenera of *Archegonus*. Probably '*P.*' *colei* is best assigned to a new subgenus (G. and R. Hahn 1972, p. 428). The Feltrim material provides some indication of the relationships between the subgenera of *Archegonus*.

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Family PROETIDAE Hawle and Corda 1847

Subfamily CYRTOSYMBOLINAE Hupé 1953

Genus ARCHEGONUS Burmeister 1843

Subgenus ARCHEGONUS (WEANIA) Campbell and Engel 1963

Type species. *Weania goldringi* Campbell and Engel 1963.

Diagnosis. Campbell and Engel (1963, p. 108) revised by Osmólska (1970, p. 117).

Archegonus (Weania) feltrimensis sp. nov.

Text-figs. 1-3, 6, 10

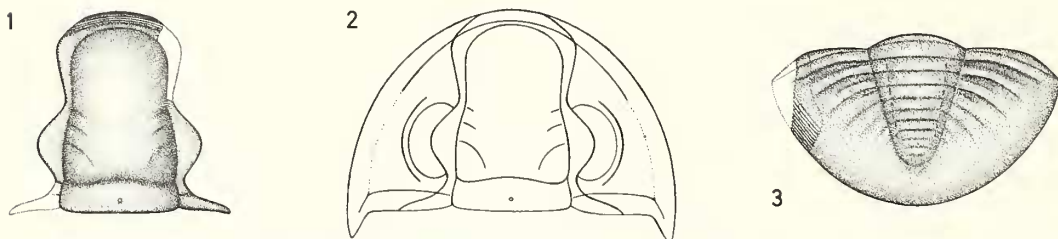
Holotype. Cranidium no. 9513, text-figs. 1, 10b.

Type locality. Feltrim Hill, Co. Dublin, Ireland. For locality details see Hudson *et al.* (1966, pp. 253, 257 and Pl. 23).

Type horizon. Black mudstone of the Lower Viséan (C_2S_1 subzone, *Ammonellites* stage, cu II β). Known only from type locality. Material, 403 specimens as listed in Hudson *et al.* (1966, pp. 276–277).

Diagnosis. As for subgenus with the following: Glabella subrectangular, relatively long, region posterior to γ only slighter broader than region anterior to γ . Anterior border prominent, elevated. Anterior part of fixed cheek very narrow; palpebral lobe long and wide (tr.); posterior part of fixed cheek short. Free cheek with very large eye and short genal spine. Pygidium short, 9–11 rings, 4–7 ribs. Anterior branch of the ribs somewhat elevated. Ribs fading on outer part of pleurae; no border furrow.

Description. All specimens are internal moulds, therefore the furrows of the cephalon and pygidia are relatively broad and shallow. On the exterior of the exoskeleton they may have been narrower and deeper.



TEXT-FIGS. 1–3. *Archegonus (Weania) feltrimensis* sp. nov. *Ammonellites* stage, C_2S_1 , Feltrim, Co. Dublin, Ireland. See also text-fig. 10. 1, Cranidium, holotype, no. 9513. 2, Reconstruction of cephalon. 3, Pygidium, no. 9503.

Cranidium. Glabella relatively massive, outline subrectangular, incised by γ , depressed vertically; posterior part (between palpebral lobes) broader than anterior. Glabellar furrows 1p impressed, curved, nearly extending to occipital furrow; preglabellar lobes (L1) partially separated from rest of glabella. Glabellar furrows (2p–3p) short and shallow on holotype, but more strongly impressed on other specimens. Occipital furrow incised, slightly curved, projecting forward at sagittal line, curving back behind preoccipital glabellar lobes, projecting forward again near axial furrow. Occipital node near to posterior border of cranidium; central part of ring wider (sag.) than laterally. Preglabellar region relatively broad (sag.), divided into a narrow, deepened preglabellar field and a broad, elevated, anterior border equipped with 3–4 parallel lines. Axial furrows well marked. Anterior branch of facial suture long, scarcely diverging; anterior part of fixed cheek narrow, similar to *Archegonus (Angustibole)*. β rounded, situated within the projection of δ . α marked by a slight knick. Palpebral lobe long and wide (tr.), projecting laterally; γ , δ , and ϵ gently curved. Posterior branch short, initially running sub-parallel to axial furrow, then (at ζ) curving outward, forming the long (tr.) and narrow (exsag.) posterior portion of fixed cheek. Posterior border furrow indistinct, shallow. Ornamentation of glabella and occipital ring weakly granular (not shown in text-fig. 1). Length of cranidium 5.6 mm; length of glabella 4.2 mm; length of β – β 1.5 mm; length of palpebral lobe (γ – ϵ) 1.9 mm; length of ϵ – ω 0.9 mm; breadth of cranidium at β – β 3.5 mm; breadth of cranidium at δ – δ 4.75 mm; breadth of glabella at δ – δ 3.2 mm.

Free cheek (text-fig. 10a). Cheek area plane, not rising against eye (diagenetic compaction?). Border region narrow, slightly elevated (less elevated than anterior border of cranidium). Eye large, strongly curved, slightly raised above the cheek area; eye furrow weak. Number of lenses in no. 9506 (length of eye 1.6 mm) about 250–300, in no. 9515 (length of eye 2.5 mm, text-fig. 10f) about 500–600. (This is high for a cyrtosymbolinid trilobite.) Posterior border furrow deeply incised, vanishing against lateral border, not continuing in lateral border furrow. Genal spine blunt and short in no. 9506, longer in no. 9510 (text-fig. 10c). Surface of free cheek nearly smooth. Length of free cheek 3.5 mm; breadth of free cheek (at ϵ) 2.3 mm.

Cephalon (text-fig. 2). Shape rounded, characterized by relatively slender glabella and large eyes. Border elevated in front of glabella, descending on the anterior part of free cheeks, disappearing against genal spines. Cephalon less vaulted than in other species of *A. (Weania)*.

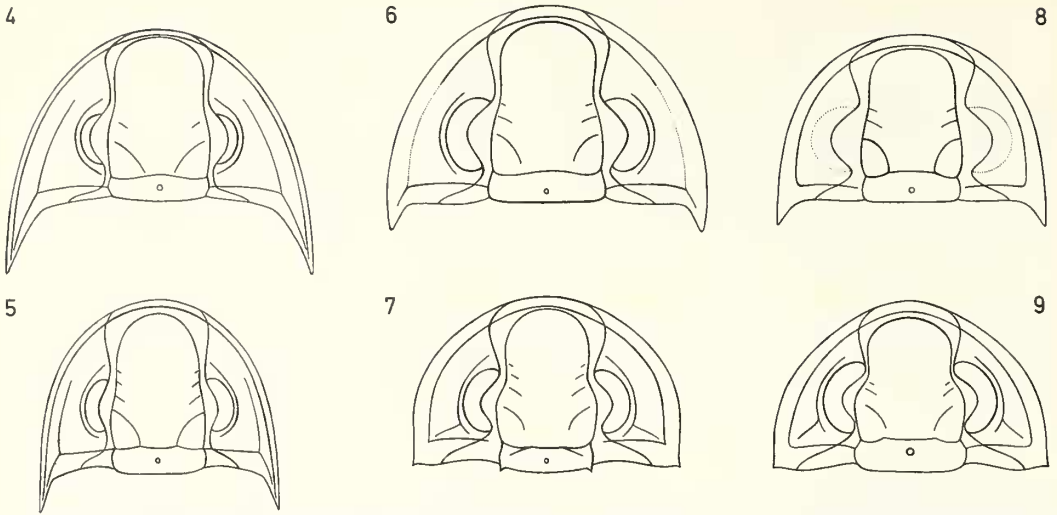
Pygidium. Shape rounded, broader than long (breadth to length ratio 1:1.63). Axis massive, broader than one pleura, tapering rapidly, terminating in a blunt curve; short in comparison with total length of pygidium. Axis completely subdivided into eleven rings; ring furrows straight (tr.), clearly incised. Appendage muscle scars, oval, shallow, near to the axial furrows which are well pronounced. 6–7 ribs on each pleura. Ribs 1–4 distinct; anterior branch slightly elevated, slowly ascending from pleural furrow, quickly descending to the following rib furrow; posterior branch low. Remaining ribs (5–7) vaguely indicated by somewhat raised anterior branch. Pleural furrows broad and shallow, rib furrows deeply incised. Ribs not reaching to outer border of pygidium; border region smooth, no border furrow. Axis arched, but pleurae planar. Connecting half-ring and connecting half-ribs slightly projecting anteriorly. Doublure (seen on anterior part of left pleura) relatively broad, ornament of faint parallel lines. Surface of pygidium smooth. Length of pygidium 4.6 mm; length of axis 3.5 mm; breadth of pygidium 7.5 mm; breadth of axis 2.75 mm.

Variation. In most features the pygidia are very uniform. The most important difference is in the expression of rings and ribs. In pygidium no. 9502 and no. 9508 only nine rings are clearly discernible, in no. 9502, no. 9504, and no. 9507 only 3–4 ribs are well defined.

DISCUSSION

The characteristic features of *A. (Weania)* are: (i) the massive glabella, broadened between the palpebral lobes; (ii) the elevation of the prominent cephalic border, both on the cranidium and free cheeks; (iii) the reduction of the genal spines; (iv) the large size of the eyes; (v) a short pygidium with relatively few rings and ribs; and (vi) the elevation of the anterior branch of the pygidial ribs. The most important features are the shape of the glabella and the size of the eyes, characteristics which are confined to *A. (Weania)*, occurring in all known species of the subgenus.

We include the following species in *A. (Weania)*: *A. (Weania) goldringi* (Campbell and Engel 1963), the type species, *A. (Weania) librovitchi* (Weber 1937), and *A. (Weania) osmolskae* G. and R. Hahn 1972 [= *A. (Weania) anglica* (Osmólska 1970)].

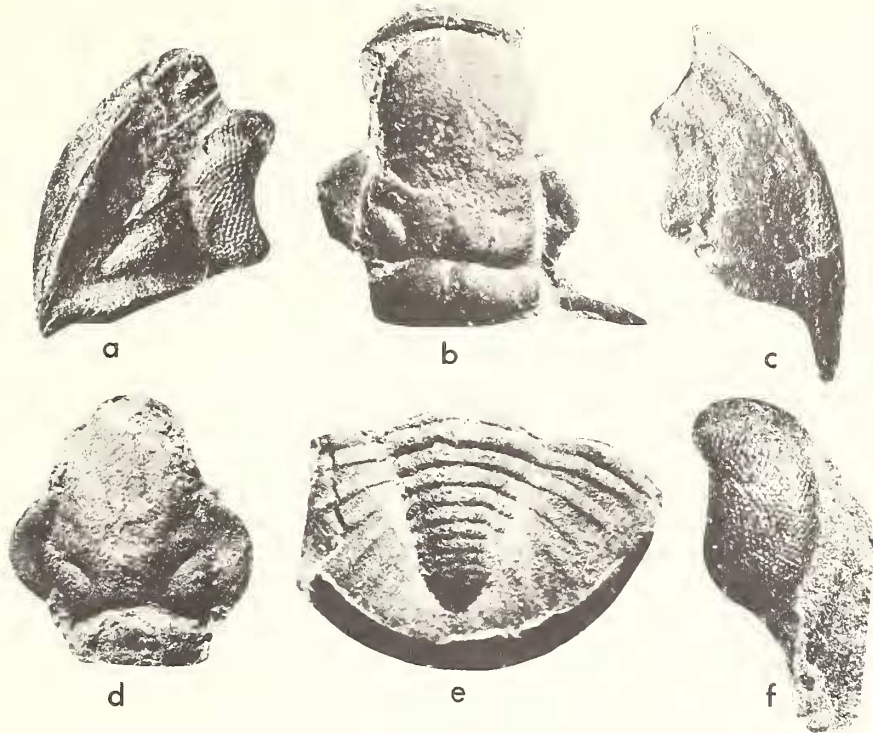


TEXT-FIGS. 4-9. Comparison of cephala of *Archegonus* (*Weania*) and relatives. 4, *Archegonus* (*Angustibole*) *winterbergensis* G. Hahn 1965. Lower Viséan, *Ammonellipsites* stage, cu II γ , Winterberg, Harz-Mountains, Germany. After G. Hahn 1965. 5, *Archegonus* (*Belgibole*) *belgicus* (G. Hahn 1963). Upper Tournaisian, *Ammonellipsites* stage, cu II β , Modave, Belgium. After G. Hahn 1963. 6, *Archegonus* (*Weania*) *feltrimensis* sp. nov. Lower Viséan, *Ammonellipsites* stage, C₂S₁, Feltrim, Co. Dublin, Ireland. 7, *Archegonus* (*Weania*) *librovitchi* (Weber 1937). Upper Viséan, *Goniatites* stage, Kizil river, S-Urals, U.S.S.R. After Weber 1937 and Osmólska 1970. 8, *Archegonus* (*Weania*) *goldringi* (Campbell and Engel 1963), *type species*. Lower Tournaisian, Tulcumba Sandstone, New South Wales, Australia. After Campbell and Engel 1963. 9, *Archegonus* (*Weania*) *osmolskae* G. and R. Hahn 1972 [= *Archegonus* (*Weania*) *anglica* (Osmólska 1970)]. Viséan, D₁, Narrowdale, Staffordshire, England. After Osmólska 1970.

Proetus zarecznyi Jarosz 1914, assigned to *A.* (*Weania*) by Osmólska (1970), is included by us with *A.* (*Belgibole*); *Phillipsia colei* M'Coy 1844, also assigned to *A.* (*Weania*) by Osmólska (1970) may represent a new subgenus of *Archegonus*; see also G. and R. Hahn (1969, p. 118; 1972, p. 428).

The elevation of the cephalic border is prominent in *A.* (*Weania*) *osmolskae*, and to a lesser degree in *A.* (*Weania*) *librovitchi*, but is only slightly indicated in the type species; and is therefore less important taxonomically than the shape of the glabella and the size of the eyes. The remaining features (iii), (v), and (vi) are characteristic of all species of *A.* (*Weania*), but they also occur in other subgenera of *Archegonus*. Reduction of the genal spines occurs in *A.* (*Belgibole*) and *A.* (*Waribole*); the elevation of the anterior branches of the pygidial ribs occurs in *A.* (*Belgibole*) and *A.* (*Waribole*) *abruptirhachis* (R. and E. Richter 1951). In contrast to *A.* (*Weania*) the pygidium of *A.* (*Belgibole*) is much more vaulted and the elevation of the anterior branches of the pygidial ribs is much more prominent.

A. *feltrimensis* sp. nov. combines the characteristics of several subgenera of *Archegonus*. The shape of the glabella is unlike that in *A.* (*Weania*), *A.* (*Waribole*), and *A.* (*Belgibole*). It is too slender for *A.* (*Weania*), especially between the palpebral lobes; but in comparison with the other subgenera it is too massive anteriorly. Thus the glabella of *A.* *feltrimensis* is intermediate between *A.* (*Waribole*) and *A.* (*Weania*), so that *A.* (*Weania*) may be interpreted as a descendant of *A.* (*Waribole*) in this



TEXT-FIG. 10. *Archegonus (Weania) feltrimensis* sp. nov., internal moulds. Lower Viséan, *Ammonellipsites* stage, C₂S₁, Feltrim, Co. Dublin, Ireland. *a*, Free cheek, negative impression, reversed by photographic effect, with eye well preserved and a short genal spine, $\times 11.4$ (No. 9506). *b*, Cranidium, holotype, $\times 6.9$ (No. 9513). *c*, Free cheek, with genal spine longer than in text-fig. 10*a*, $\times 12.3$ (No. 9510). *d*, Cranidium, with anterior glabella furrows (p₂-p₃) better preserved than the holotype, $\times 10.1$ (No. 9514). *e*, Pygidium, with well-marked rings and ribs, $\times 7.0$ (No. 9503). *f*, Part of free cheek, with eye well preserved, $\times 10.0$ (No. 9515).

respect. A glabella similar to the new species occurs in *A. (Angustibole) winterbergensis* G. Hahn 1965 (text-fig. 4), also a descendant of *A. (Waribole)*.

The cephalic border of the new species is moderately elevated, more than in *A. (Weania) goldringi* but less than in *A. (Weania) osmolskae*, and fits into our concept of *A. (Weania)*. The degree of reduction of the genal spines is similar to other species of *A. (Weania)* and *A. (Belgibole)* (text-fig. 5), and also to *A. (Waribole) abruptirhachis*. This is only significant at the species level. The eyes of the new species are very large, agreeing with all other species of *A. (Weania)*. The anterior part of the fixed cheeks, however, differs from *A. (Weania) goldringi* and *A. (Weania) librovitchi* in being narrower, as in *A. (Weania) osmolskae* and *A. (Angustibole) winterbergensis* (compare text-figs. 4 and 6-9). Over-all the cranidium agrees more with *A. (Angustibole) winterbergensis* than with *A. (Weania) osmolskae*.

The pygidium of the new species is characterized by its shortness, a few rings (9-11) and ribs (7), the slightly elevated anterior branches of the ribs, and the manner

in which the ribs fade against the border. A similar short pygidium is seen in *A. (Weania) goldringi* (8 rings, 5–6 ribs) and in most species of *A. (Waribole)*, whereas in *A. (Weania) librovitchi* and *A. (Weania) osmolskae* the pygidia are longer, with 11–12 rings and 9–10 ribs. The ribs of the new species are intermediate between *A. (Waribole)* and *A. (Weania)*: whereas the ribs terminate against the border as in *A. (Waribole)*, the elevation of the anterior branches agrees with *A. (Weania)*. The pygidium of *A. (Angustibole)* differs from the new species: the ribs are not elevated and the axis and pleurae are only slightly vaulted.

Thus the features of the new species may be summarized: (1) Features characteristic of *A. (Weania)*: the elevation of the cephalic border, the large size of the eyes, the shape of the pygidium, and the elevation of the anterior branches of the ribs. (2) Features intermediate between *A. (Waribole)* and *A. (Weania)*: the shape of the glabella and the termination of the pygidial ribs against the border. (3) Features distinct from *A. (Waribole)* and most species of *A. (Weania)*: the narrow anterior fixed cheeks. Therefore 'progressive' features of *A. (Weania)* occur in the new species, with some 'primitive' features of *A. (Waribole)*. We prefer to include the species in *A. (Weania)*, because the features of that subgenus are predominant.

This discussion sheds light on the systematic position of *A. (Weania)*. It shows that it is a member of the *Archegonus*-group among the *Cyrtosymbolinae*, descending from *A. (Waribole)*, not from *Cyrtosymbole (Pseudowaribole)* as concluded by Osmólska (1970). In all known species of *Cyrtosymbole (Pseudowaribole)* the glabella is long and slender, never as short and massive as in *A. (Weania)*. *A. (Waribole)* and *A. (Belgibole)* are the subgenera closest to *A. (Weania)*; the first, the common ancestor; the second, as the most similar evolutionarily parallel branch. The close relationship is shown best by the structure of the pygidia. The elevation of the anterior branches of the ribs and the strongly differentiated relief on the axis and pleurae first occurs in *A. (Waribole) abruptirhachis*, as well as in *A. (Weania)*, and reaches its maximum in *A. (Belgibole)*. On the other hand, the structure of the *A. (Waribole)* type of glabella persists in *A. (Belgibole)*, whereas *A. (Weania)* evolves a new shape. Palaeoecologically *A. (Weania)* and *A. (Belgibole)* both occur in Carboniferous Limestone facies, whereas the other subgenera of *Archegonus* are only found in the Culm facies. The *Archegonus*-subgenera are very closely related, with several transitional species, and it would be unwise to elevate the subgenera to genera.

The four described species of *A. (Weania)* may be divided into two groups. The stratigraphically older and morphologically more primitive species are *A. (Weania) feltrimensis* (text-fig. 6) and *A. (Weania) goldringi* (text-fig. 8); the stratigraphically younger and morphologically more advanced species are *A. (Weania) osmolskae* (text-fig. 9) and *A. (Weania) librovitchi* (text-fig. 7). The two pairs are separated by the broadening of the glabella between the palpebral lobes, the degree of elevation of the cephalic border, the reduction of the genal spines, and the length of the pygidium. The first pair are characterized by their slightly broadened glabella; weakly to moderately elevated cephalic border; short, pointed genal spines and short pygidium with relatively few segments (8–11 rings, 5–7 ribs). The second pair show a broadened glabella, the cephalic border strongly elevated, the genal spines completely reduced, and the pygidium longer, resembling *A. (Belgibole)* rather than

A. (Waribole) with 11–12 rings and 9–10 ribs. Of the first pair, *A. (Weania) feltrimensis* is the more primitive, though not the older stratigraphically, since it preserves features transitional between *A. (Waribole)* and *A. (Weania)*. *A. (Weania) goldringi* has lost these transitional features, but without evolving the characteristic features of the second pair of species. *A. (Weania) osmolskae* differs from *A. (Weania) librovitchi* in its narrower anterior fixed cheeks, its more elevated cephalic border, its broader glabella, and its larger eyes. *A. (Weania) osmolskae* is the most evolved species in the subgenus, though somewhat older stratigraphically than *A. (Weania) librovitchi*. The pygidia of both species do not differ markedly (see Osmólska 1970, pl. 1, figs. 3 and 4). It is likely that the second pair evolved from the first, perhaps directly from *A. (Weania) goldringi*. In contrast, *A. (Weania) feltrimensis*, despite its primitive features, cannot be the ancestor of the other species of *A. (Weania)*, since it is stratigraphically younger than *A. (Weania) goldringi*. However, it suggests a model of the form representing the root species of the subgenus which existed about the end of the Devonian.

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